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# Fertilizer Management for Alfalfa

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Adequate soil fertility is necessary for alfalfa production on both dryland and irrigated soils of Nebraska. With adequate, but not excessive, fertilizer programs, irrigated alfalfa should produce 6 to 8 tons per acre (13 to 18 MT/ha). Dryland alfalfa on the same soils should, on the average, produce 2 to 3 tons (4.5 to 7 MT/ha) per acre.

## Begin With a Soil and Water Test

The first step for efficient fertilizer management for alfalfa is no different than fertilizer management for other crops. A good soil test is required. Soil samples can be collected at any time throughout the year. Samples should be collected at least 4 to 5 weeks before the time for fertilizer application.

It's also important to remember that nutrients contained in the irrigation water can be used by the irrigated alfalfa crop. The irrigation water may contain significant amounts of lime, potassium and sulfur and thus reduce the cost of the fertilizer program. Fluctuations occur, but the nutrient content of irrigation water seldom changes enough to require adjustment of fertilizer programs. Therefore, the water normally needs to be analyzed only once.

## Lime

Lime should be used for establishment and high yields the first 2 years after seeding in the eastern third of Nebraska where the pH of the topsoil is 6.2 or less. Once alfalfa roots penetrate deep enough to reach soil materials with a high pH, there will be no further growth response from applied lime.

Many of the sandy soils in Nebraska are acid and lime may be needed. When needed, lime is essential for successful establishment of alfalfa on either dryland or irrigated sandy soils. For all soils, the rate of change in soil pH brought about by liming depends on the fineness of the limestone applied. Fine materials produce a rapid change. Changes are slower when coarse materials are applied. The amount of lime needed is determined directly from the results of a soil test.

Dolomitic limestone containing both calcium (Ca) and magnesium (Mg) can be purchased. However, since research conducted up to this time has shown that Mg does not increase alfalfa production on the soils of Nebraska, there is no need to purchase dolomitic limestone instead of the normal agricultural limestone at this time.

Irrigated alfalfa will receive some lime and magnesium from the irrigation water. The amounts applied with the water can easily be determined from the results of an analysis of a sample of irrigation water.

All liming materials should be broadcast and incorporated before the alfalfa is seeded. There is very little benefit from topdressed lime.

## Fertilizer for Establishment

Fertilizer required for alfalfa production can be broadcast and incorporated before establishment, applied with a drill at planting time, or applied by a combination of these two methods. When low rates of nutrients are needed, the application of fertilizer with the drill when seeding would be appropriate.

Fertilizer containing high levels of both nitrogen (N) and potassium ($K_2O$) should not be placed in direct contact with the seed. These

nutrients may reduce germination and stand. Fertilizers containing only phosphate ($P_2O_5$) should cause no problems when placed in direct contact with the seed. The sum of N and $K_2O$ applied with the drill should be limited to less than 20 pounds per acre (22 kg/ha). If soil is drier than normal, limit to ½ this amount.

For fields where high rates of nutrients are required and especially for irrigated alfalfa, some of the fertilizer should be broadcast and incorporated and some should be applied with the drill. Many farmers and ranchers report that the application of some N with the drill will increase the probability of obtaining a good stand. Nitrogen rates, however, should be limited to 10-15 pounds per acre (11 to 17 kg/ha). Additional N will reduce the effectiveness of the nodules. When this occurs, the alfalfa crop becomes dependent on fertilizer N for growth and development.

### Phosphorus

Phosphorus (P) will be needed for top yields of alfalfa on many of the soils in Nebraska. Suggested rates are listed in *Table 1.* The rates listed can be used either for new or established stands. If a drill is used in planting, the amount of phosphate applied with the drill should be subtracted from the total required to determine the amount needed for broadcast application.

Yearly applications of phosphorus are suggested for irrigated alfalfa. For dryland production on acid soils an application of 3 times the recommended rate at seeding should be sufficient for 3 or 4 years. For dryland production on soils with a pH greater than 7.0, yearly applications of phosphate may be more beneficial.

### Potassium

Potassium (K) may be needed for alfalfa production on some sandy soils and suggested rates are listed in *Table 2.* Potassium fertilizers will seldom be needed on the non-sandy soils of Nebraska. As with phosphorus use, yearly applications are recommended for irrigated alfalfa while large applications sufficient for 3 or 4 years applied at seeding are suggested for dryland production. For irrigated alfalfa, the amount of potassium applied in the irrigation water can be subtracted from the suggested rates needed in a fertilizer program.

### Sulfur

The importance of sulfur (S) for alfalfa on the sandy soils has been recognized in Nebraska since 1952. Research has shown that sulfur fertilizers will not be needed for either dryland or irrigated alfalfa production on the non-sandy soils of Nebraska. In eastern and central Nebraska, a need for sulfur is most likely when the soil is sandy and the organic matter content is less than 1.0% and where irrigation water (if used) is low in sulfur. In western Nebraska, a response to sulfur will be most likely on the sandy soils with an organic matter content of less than 0.6%.

Where needed, yearly applications of 30-40 pounds of sulfur per acre (34-45 kg/ha) are suggested for irrigated alfalfa. The use of 100 pounds (122 kg/ha) of sulfur per acre once every 3 years should provide adequate amounts of this nutrient for dryland alfalfa on sandy soils. Research has shown that fertilizers containing elemental S are as effective for alfalfa production as those containing sulfate-sulfur.

### Micronutrients

Except for boron (B), micronutrient deficiencies have not been found in alfalfa in Nebraska. Boron will not be needed on most soils, but may improve yields on some sandy soils. At present, we would recommend that boron be used on a trial basis only. The boron content of the irrigation water should be checked before this nutrient is applied to irrigated alfalfa.

### Nitrogen Recommendations

Alfalfa is a legume. If the seed is properly inoculated with nitrogen fixing bacteria, nitrogen fertilizer is seldom needed on non-sandy soils. For sandy soils, small amounts of nitrogen applied with the drill at planting may help establishment. New seedings on some sandy soils may turn light green to yellow because of unsuccessful inoculation. Topdressing with 40 pounds (45 kg/ha) of nitrogen per acre may be necessary in these situations.

### Special Problems

On some sandy soils, new seedlings of alfalfa may be light green or yellow. This condition is

most common in early spring. If this occurs on sandy soils along river bottoms where the soil pH is high, the yellow color can be iron chlorosis. This will usually disappear as temperatures rise and growing conditions improve.

**Table 1. Recommended rates of phosphorus**

| *Phosphorus soil test level ppm* | | | *Phosphorus to apply* | | |
|---|---|---|---|---|---|
| | | | *Irrigated*[1/] | *Non-irrigated* | |
| Bray-1 | Olsen | | Annually lb/A (kg/ha) $P_2O_5$ | Annually[2/] lb/A (kg/ha) $P_2O_5$ | Every[3/] 2 yrs $P_2O_5$ |
| 0 to 5 | 0-3 | Very Low (VL) | 80 (89) | 40 (45) | 80 (90) |
| 6 to 15 | 4-7 | Low (L) | 60 (67) | 30 (34) | 60 (67) |
| 16 to 25 | 8-14 | Medium (M) | 40 (46) | 20 (22) | 40 (45) |
| greater than 25 | > 14 | High (H) | | | |

Phosphorus Test - Bray $P_1$

1. For established stands where the yield goal is 6 to 8 tons per acre (13 to 18 MT/ha) with good water management, annual early spring applications are recommended. For new seedings of irrigated alfalfa, plow-down or disk-in phosphate fertilizer ahead of seeding at twice the recommended annual rate if soils are low or very low in soil test phosphorus. This should provide adequate phosphate for the first year of production.
2. With the exception of calcareous (high lime) soils, plow-down or disk-in applications ahead of seeding at 3 times the recommended annual rate are suggested for nonirrigated alfalfa. This should meet phosphorus needs for 3 to 4 years.
3. On calcareous soils in northeast Nebraska (Crofton and Nora soil types) application ahead of seeding, followed by topdressing every 2 years, was found to be the most profitable.

**Table 2. Potassium recommendations.**

| *Potassium soil test level* | | *Potassium to apply annually* |
|---|---|---|
| ppm K | | lb $K_2O$/A (kg/ha) |
| 0 to 40 | Very Low (VL) | 120 (135) |
| 41 to 74 | Low (L) | 80 ( 90) |
| 75 to 125 | Medium (M) | 40 ( 45) |
| 126 to 150 | High (H) | 0 |
| greater than 150 | Very High (VH) | 0 |

Potassium Test - Exchangeable

**File Under: FIELD CROPS**
**B-1, Forage**
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